

WHAT IS CLAIMED IS:

1 1. A method of using an interferometric confocal microscope to measure features of
2 a trench or via in a substrate, wherein the interferometric confocal microscope produces a
3 measurement beam, the method comprising:

4 focusing the measurement beam at a selected location at or near the bottom of the
5 trench or via to excite one or more guided-wave modes within the trench or via;

6 measuring properties of a return measurement beam that is produced when the
7 measurement beam is focused at the selected location, said return measurement beam
8 including a component corresponding to a radiated field from the one or more guided-wave
9 modes that are excited within the trench; and

10 determining the features of the trench or via from the measured properties of the
11 return measurement beam.

1 2. The method of claim 1, further comprising scanning the measurement beam in a
2 direction that is substantially normal to the substrate to locate the bottom of the trench or via.

1 3. The method of claim 1, wherein determining features involves determining a depth
2 of the trench or via.

1 4. The method of claim 1, further comprising:

2 focusing the measurement beam at a selected distance above the surface of the
3 substrate and over the trench or via; and

4 measuring properties of a return measurement beam that is produced when the
5 measurement beam is focused at the selected distance above the surface of the substrate and
6 over the trench or via,

7 wherein determining the features of the trench or via involves combining
8 measurements of properties of the first-mentioned return measurement beam and
9 measurements of properties of the second-mentioned return measurement beam.

1 5. The method of claim 4, wherein the selected location is a distance Z1 below the
2 top surface of the substrate, where the selected distance is a distance Z2 above the surface of
3 the substrate, and wherein Z1 equals Z2.

1 6. The method of claim 1, wherein the one or more guided-wave modes that are
2 excited are leaky guided-wave modes.

1 7. The method of claim 1, further comprising generating a measurement beam that is
2 asymmetric.

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4 8. The method of claim 1, further comprising generating a measurement beam that is
5 asymmetric.

1 9. The method of claim 1, wherein measuring the properties of the return
2 measurement beam comprises measuring conjugated quadratures of fields of the return
3 measurement beam.

1 10. The method of claim 4, wherein measuring properties of the field of a return
2 measurement beam that is produced when the measurement beam is focused at the selected
3 distance above the surface of the substrate and over the trench or via comprises measuring
4 conjugated quadratures of fields of that return measurement beam.

1 11. The method of claim 10, wherein determining the features of the trench or via
2 involves combining the measurements of conjugated quadratures of fields of the return
3 measurement beam that is produced when the measurement beam is focused at the selected
4 location and measurements of conjugated quadratures of fields of the return measurement
5 beam that is produced when the measurement beam is focused at the selected distance above
6 the surface of the substrate and over the trench or via.

1 12. The method of claim 1, wherein measuring the properties of the return
2 measurement beam involves using a bi-homodyne detection technique.

1 13. The method of claim 1, wherein measuring the properties of the return
2 measurement beam involves using a quad-homodyne detection technique.

1 14. The method of claim 1, wherein the interferometric confocal microscope is a far-
2 field interferometric confocal microscope and the measurement beam is a far-field
3 measurement beam.

1 15. The method of claim 1, wherein the interferometric confocal microscope is a
2 near-field interferometric confocal microscope and the measurement beam is a near-field
3 measurement beam.

1 16. The method of claim 1, further comprising performing the steps of focusing
2 and measuring at a plurality of locations along the bottom of the trench to detect a
3 defect within the trench, wherein said selected location is one of said plurality of
4 locations.

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